CLAIMS

What is claimed is:

1. A system for introducing payloads into earth orbit, comprising:

a reusable orbital vehicle capable of being placed in earth orbit, the orbital vehicle having an outer skin surface;

a plurality of attachment positions located on the outer skin surface of the orbital vehicle; and

a first experimental package affixed to the orbital vehicle at a first one of the plurality of attachment positions wherein the first experimental package is exposed to the external atmosphere during launch and re-entry phases of a space mission and is further exposed to the environment of space while in orbit.

2. The system of claim 1, further comprising a second experimental package affixed to the orbital vehicle at a second one of the plurality of attachment positions wherein the second experimental package is exposed to the external atmosphere during launch and re-entry phases of the space mission and is further exposed to the environment of space while in orbit.

3. The system of claim 2 wherein the first and second experimental packages have uniform predetermined dimensions, the first and second ones of the plurality of attachment positions being configured to receive and retain the first and second experimental packages at the first and second ones of the plurality of attachment positions.

4. The system of claim 1 wherein the first experimental package comprises a thermal protection system.

5. The system of claim 1, further comprising an access panel on the outer skin surface of the reusable orbital vehicle wherein at least one of the plurality of attachment positions is located on the access panel.

6. The system of claim 5 wherein the access panel on the outer skin surface of the reusable orbital vehicle is removable from the reusable orbital vehicle.

7. The system of claim 1, further comprising a carrier plate configured for attachment at the first one of the plurality of attachment positions and further configured for attachment to the first experimental package wherein the carrier plate is intermediate the outer skin surface of the orbital vehicle and the first experimental package.

8. The system of claim 1, further comprising a thermal protection system affixed to the orbital vehicle to form the outer skin surface thereof, the thermal protection system at at least one of the plurality of attachment positions being configured for attachment to the first experimental package.

9. The system of claim 1 wherein the orbital vehicle has an elongated shape with first and second ends with a rocket engine positioned proximate the second end of the orbital vehicle, the first of the plurality of attachment positions being on the exterior skin of the orbital vehicle substantially at the first end.

10. The system of claim 1 wherein the orbital vehicle has an elongated shape with first and second ends with a rocket engine positioned proximate the second end of the orbital vehicle, the first of the plurality of attachment positions being on the exterior skin of the orbital vehicle forward of a midpoint between the first end and the second end.

11. The system of claim 1 wherein the orbital vehicle has an elongated shape with first and second ends with a rocket engine positioned proximate the second end of the orbital vehicle, the first of the plurality of attachment positions being on the exterior skin of the orbital vehicle rearward of a midpoint between the first end and the second end.

12. The system of claim 1 wherein the orbital vehicle has an elongated shape with first and second ends with a rocket engine positioned proximate the second end of the orbital vehicle, the system further comprising an aft skirt proximate the second end wherein the first of the plurality of attachment positions is on an exterior skin portion of the aft skirt.

13. The system of claim 1 wherein the orbital vehicle has an elongated shape with first and second ends with a rocket engine positioned proximate the second end of the orbital vehicle, the system further comprising an aft skirt proximate the second end and a protected attachment position on an interior portion of the aft skirt.

14. The system of claim 1 wherein the orbital vehicle has an elongated shape with first and second ends with a rocket engine positioned proximate the second end of the orbital vehicle, the system further comprising an aft skirt proximate the second end and an attachment member mounted to an interior portion of the aft skirt.

15. The system of claim 14 wherein the attachment member is rotatably mounted to the interior portion of the aft skirt.

16. The system of claim 14, further comprising a mounting bracket fixedly mounted to the interior portion of the aft skirt wherein the attachment member is moveably coupled to the mounting bracket.

17. The system of claim 16, further comprising a control system to control movement of the attachment member to move the attachment member and thereby position a second experimental package outside the interior portion of the aft skirt.

18. The system of claim 14 wherein the attachment member comprises a base portion having first and second ends, the base portion first end being coupled to the interior portion of the aft skirt, an intermediate portion having first and second ends, the intermediate portion first end being coupled to the coupled to the base portion second end, and a terminal portion having first and second ends, the terminal portion first end being coupled to the coupled to the intermediate portion second end.

19. The system of claim 18, further comprising a mounting bracket fixedly mounted to the interior portion of the aft skirt wherein the base portion first end is rotatably coupled to the mounting bracket.

20. The system of claim 18 wherein the terminal portion first end is rotatably coupled to the intermediate portion second end.

21. The system of claim 18, further comprising a mounting member coupled to the terminal portion second end and configured to receive the second experimental package.

22. The system of claim 1, further comprising a sensor associated with the first experimental package, the sensor generating sensor data.

23. The system of claim 22, further comprising a data storage unit electrically coupled to the orbital vehicle and electrically coupled to the sensor, the data storage unit receiving and storing the generated sensor data.

24. The system of claim 23 for use with an avionics data bus on the orbital vehicle to monitor operation of the orbital vehicle, the data storage unit being coupled to the avionics data bus on the orbital vehicle to store data related to the operation of the orbital vehicle in association with the generated sensor data.

25. The system of claim 22 wherein the first experimental package comprises a thermal protection system.

26. The system of claim 1, further comprising an initial stage coupled to the orbital vehicle to boost the orbital vehicle from a position on earth to a predetermined altitude.

27. A system for introducing payloads into earth orbit, comprising:

a reusable orbital vehicle capable of being placed in earth orbit, the orbital vehicle an elongated body portion with first and second ends with a rocket engine positioned proximate the second end of the orbital vehicle;

an aft skirt coupled to the body portion proximate the second end and extending circumferentially around the rocket engine; and

an attachment member mounted to an interior portion of the aft skirt, the attachment member configured to receive an experiment.

28. The system of claim 27 wherein the attachment member is rotatably mounted to the interior portion of the aft skirt.

29. The system of claim 27 wherein the attachment member is moveably mounted to the interior portion of the aft skirt, the system further comprising a

control system to control movement of the attachment member to move the attachment member and thereby position the experiment outside the interior portion of the aft skirt.

30. The system of claim 29 wherein the experiment is an experimental control surface.

31. The system of claim 30 wherein the control system provides steering control of the attachment member to thereby steer the experiment while positioned outside the interior portion of the aft skirt.

32. The system of claim 27 wherein the attachment member comprises a base portion having first and second ends, the base portion first end being coupled to the interior portion of the aft skirt, an intermediate portion having first and second ends, the intermediate portion first end being coupled to the coupled to the base portion second end, and a terminal portion having first and second ends, the terminal portion first end being coupled to the coupled to the intermediate portion second end.

33. The system of claim 32, further comprising a mounting bracket fixedly mounted to the interior portion of the aft skirt wherein the base portion first end is moveably coupled to the mounting bracket.

34. The system of claim 32 wherein the terminal portion first end is moveably coupled to the intermediate portion second end.

35. The system of claim 32, further comprising a mounting member coupled to the terminal portion second end and configured to receive the experiment.

36. The system of claim 27, further comprising a sensor associated with the experiment, the sensor generating sensor data and a data storage unit to receive and store the generated sensor data.

37. A method for introducing payloads into earth orbit, the method comprising:

attaching a first exterior experiment to a first external attachment position located on an outer surface portion of a reusable launch vehicle;

launching the reusable launch vehicle into orbit to thereby expose the first experiment to an external environment during launch and in orbit;

re-entering the reusable launch vehicle from orbit to thereby expose the first experiment to an external environment during re-entry; and

returning the first experiment to an owner of the first experiment.

38. The method of claim 37, further comprising collecting data from the first experiment and delivering the collected data to the owner of the first experiment.

39. The method of claim 38 wherein collecting data from the first experiment is performed during at least one of a plurality of time periods comprising during launch, while in orbit and during re-entry.

40. The method of claim 37 wherein collecting data from the first experiment comprises monitoring a sensor associated with the first experiment.

41. The method of claim 37, further comprising:

attaching a second exterior experiment to a second external attachment position located on an outer surface portion of the reusable launch vehicle, the second external attachment position being different from the first external attachment position;

launching the reusable launch vehicle into orbit to thereby expose the second experiment to an external environment during launch and in orbit;

re-entering the reusable launch vehicle from orbit to thereby expose the second experiment to an external environment during re-entry; and

returning the second experiment to an owner of the second experiment.

42. The method of claim 41, further comprising collecting data from the second experiment and delivering the collected data to the owner of the second experiment.

43. The method of claim 42 wherein collecting data from the second experiment is performed during at least one of a plurality of time periods comprising during launch, while in orbit and during re-entry.

44. The method of claim 37 wherein the first experiment comprises a thermal protection system.

45. The method of claim 37 for use with a reusable launch vehicle having an access panel on the outer surface portion thereof wherein the first attachment position is located on the access panel and attaching the first experiment comprises attaching the first experiment to the access panel.

46. The method of claim 45 wherein the access panel on the outer surface portion of the reusable launch vehicle is removable from the reusable launch vehicle, the method further comprising removing the access panel.

47. The method of claim 37, further comprising mounting the first experiment to an intermediate carrier plate wherein attaching the first experiment comprises attaching the carrier plate to the first attachment position.

48. The method of claim 37 for use with a launch vehicle having a thermal protection system affixed to the launch vehicle to form the outer surface portion thereof, wherein attaching the first experiment comprises attaching the first experiment to the thermal protection system at the first attachment position.

49. The method of claim 37 wherein the reusable launch vehicle has an elongated shape with first and second ends with a rocket engine positioned proximate the second end of the reusable launch vehicle, and attaching the first experiment to the first attachment position comprises attaching the first experiment to the outer surface portion of the reusable launch vehicle proximate the first end.

50. The method of claim 37 wherein the reusable launch vehicle has an elongated shape with first and second ends with a rocket engine positioned proximate the second end of the reusable launch vehicle, and attaching the first experiment to the first attachment position comprises attaching the first experiment to the outer surface portion of the reusable launch vehicle intermediate the first and second ends.

51. The method of claim 37 wherein the reusable launch vehicle has an elongated shape with first and second ends with a rocket engine positioned proximate the second end of the reusable launch vehicle, and attaching the first experiment to the first attachment position comprises attaching the first experiment to the outer surface portion of the reusable launch vehicle proximate the second end.

52. The method of claim 37 wherein the outer surface portion of a reusable launch vehicle is exposed to a range of temperatures, the method further comprising selecting the first external attachment position based on a desired exposure temperature for the first experiment.

53. The method of claim 37, further comprising generating data associated with the first experiment.

54. The method of claim 53, further comprising storing the data generated from the first experiment and delivering the generated data to the owner of the first experiment.

55. The method of claim 53 wherein collecting data from the first experiment is performed during at least one of a plurality of time periods comprising during launch, while in orbit and during re-entry.

56. The method of claim 37, further comprising mounting an attachment member to the interior portion of the aft skirt.

57. The method of claim 56 wherein the attachment member is movably mounted to the interior portion of the aft skirt, the method further comprising attaching a second experiment to the attachment member and moving the attachment member to thereby position the second experiment outside the interior portion of the aft skirt.

58. A method for introducing payloads into earth orbit using a reusable launch vehicle, the method comprising:

launching the reusable launch vehicle into orbit, the launch vehicle having an attachment member coupled thereto, the attachment member having a first experiment coupled thereto and being mounted in a location protected from a slipstream; and

during flight of the launch vehicle, moving the first experiment to a position away from the protected location and into the slipstream.

59. The method of claim 58 wherein the first experiment is an experimental control surface.

60. The method of claim 59, further comprising steering the attachment member to thereby steer the first experiment while positioned in the slipstream.

61. The method of claim 59 wherein moving the first experiment into the slipstream is performed during a re-entry of the launch vehicle.

62. The method of claim 58, further comprising re-entering the launch vehicle from orbit and returning the first experiment to an owner of the first experiment.

63. The method of claim 58 wherein the first experiment comprises a thermal protection system.

64. The method of claim 58, further comprising generating associated with from the first experiment and delivering the generated data to the owner of the first experiment.

65. The method of claim 64 wherein generating data from the first experiment is performed during at least one of a plurality of time periods comprising during launch, while in orbit and during re-entry.

66. The method of claim 64 wherein generating data from the first experiment comprises monitoring a sensor associated with the first experiment.

67. The method of claim 58, further comprising attaching a second exterior experiment to a second external attachment position located on an outer surface portion of the launch vehicle.

68. The method of claim 67, further comprising re-entering the launch vehicle from orbit and returning the second experiment to an owner of the second experiment.

69. The method of claim 68, further comprising generating data from the second experiment and delivering the generated data to the owner of the second experiment.

70. The method of claim 69 wherein generating data from the second experiment is performed during at least one of a plurality of time periods comprising during launch, while in orbit and during re-entry.